

IN THE CLAIMS

Claims 1-10 and 20 are pending in this application, wherein new claims 21-30 are being submitted for consideration, as follows:

1. (Previously Presented) A data processing system comprising:
 - a first storage system communicably connected to a host unit; and
 - a second storage system and a third storage system each communicably connected to said first storage system, wherein:
 - (1) said first storage system comprises:
 - a first data storage area for storing data transmitted from the host unit;
 - a first journal storage area for storing a journal used for producing a copy of data stored in said first storage area; and
 - a first control unit which writes the data transmitted from said host unit into said first data storage area, writes the journal of the data written into said first data storage area into said first journal storage area, and transmits said journal present in said first journal storage area to each of said second and third storage systems in response to a read request from each of said second and third storage systems;
 - (2) said second storage system comprises:
 - a second data storage area for storing a copy of the data present in said first data storage area;
 - a second journal storage area for storing said journal; and
 - a second control unit which schedules a first journal read timing independently from said third storage system, transmits said read request to said first storage system to read said journal from said first storage system at said independently scheduled first journal read timing, writes the read-out journal into said second journal storage area, produces a copy of the data present in said first data storage area based on said journal present in said second journal storage area at an independently scheduled restore timing, and writes the copy into said second data storage area; and
 - (3) said third storage system comprises:
 - a third data storage area for storing a copy of the data present in said first data storage area;
 - a third journal storage area for storing said journal; and
 - a third control unit which schedules a second journal read timing

independently from said second storage system, transmits said read request to said first storage system to read said journal from said first storage system at said independently scheduled second journal read timing, writes the read-out journal into said third journal storage area, produces a copy of the data present in said first data storage area based on said journal present in said third journal storage area at an independently scheduled restore timing, and writes the copy into said third data storage area, and

said first control unit of said first storage system detects as to whether or not said journal present in said first journal storage area has been read by said second and third storage systems, holds said journal present in said first journal storage area till the journal is read by both said second and third storage systems, and can delete said journal present in said first journal storage area after the journal has been read by both said second and third storage systems.

2. (Previously Presented) The data processing system according to claim 1, wherein

(1) said first storage system comprises:

a plurality of physical storage units;

said first control unit of said first storage system comprises a host adapter for exchanging data with said host device, a disk adapter for exchanging data with said plurality of physical storage units, and a cache memory for storing the data received by said host adapter and the data received by said disk adapter; and

said first control unit allocates the storage areas held by said plurality of physical storage units in said first storage system to said first data storage area and said first journal storage area;

(2) said second storage system comprises:

a plurality of physical storage units;

said second control unit of said second storage system comprises a host adapter for exchanging data with said first storage system, a disk adapter for exchanging data with said plurality of physical storage units, and a cache memory for storing the data received by said host adapter and the data received by said disk adapter; and

said second control unit allocates the storage areas held by said plurality of physical storage units in said second storage system to said second data storage area

and said second journal storage area; and

(3) said third storage system comprises:

a plurality of physical storage units;

said third control unit of said third storage system comprises a host adapter for exchanging data with said first storage system, a disk adapter for exchanging data with said plurality of physical storage units, and a cache memory for storing the data received by said host adapter and the data received by said disk adapter; and

said third control unit allocates the storage areas held by said plurality of physical storage units in said third storage system to said third data storage area and said third journal storage area.

3. (Original) The data processing system according to claim 1, wherein

said third control unit of said third storage system controls the time interval of said journal read according to the number of data in the journal that has been read from said first journal storage area.

4. (Original) The data processing system according to claim 1, wherein

said third control unit of said third storage system controls the time interval of said journal read according to the communication quantity of data exchanged between said first storage system and said third storage system.

5. (Original) The data processing system according to claim 1, wherein

said third control unit of said third storage system controls the time interval of said journal read according to the storage capacity of said journal held in said third data storage area.

6. (Original) The data processing system according to claim 1, wherein

said third control unit of said third storage system controls the time interval of said journal read according to the processing load of said third storage system.

7. (Original) The data processing system according to claim 1, wherein

said third control unit of said third storage system reads from said first storage system information relating to the storage capacity of said journal held in said first

journal storage area in said first storage system and controls the time interval of said journal read according to the information relating to the storage capacity of said journal that was read out.

8. (Original) The data processing system according to claim 1, wherein

said first storage system owns management information relating to said first journal storage area; and

said third control unit of said third storage system reads from said first storage system the management information relating to said first journal storage area, which is owned by the first storage system, and controls the time interval of said journal read according to the management information relating to said first journal storage area that was read out.

9. (Original) The data processing system according to claim 1, wherein

said first data storage area in said first storage system has a plurality of logical volumes;

said first control unit writes into said first journal storage area a plurality of journals each corresponding to a plurality of data stored in said plurality of logical volumes;

information relating to an update sequence of said plurality of data, each corresponding to said plurality of journals, is contained in said plurality of journals stored in said first journal storage area; and

each of the second and third control units of said second and third storage systems produces copies of said plurality of data based on said plurality of journals according to said update sequence contained in said plurality of journals read out from said first storage system and writes those copies in respective said second and third data storage areas.

10. (Original) The data processing system according to claim 1, wherein

said third storage system controls said restore timing according to the processing load of said third storage system.

11-19. (Cancelled)

20. (Previously Presented) The data processing system according to claim 1, wherein

said first control unit of said first storage system detects as to whether or not said journal present in said first journal storage area has been read by said second and third storage systems, holds said journal present in said first journal storage area till the journal is read by both said second and third storage systems, and deletes said journal present in said first journal storage area after the journal has been read by both said second and third storage systems.

21. (New) A data processing system comprising:

a first storage system connected to a host unit; and

a second storage system and a third storage system each connected to said first storage system, wherein:

(1) said first storage system comprises:

a first data storage area for storing data transmitted from the host unit as a primary volume;

a first copy data storage area for storing a copy of data to be stored in said first storage area; and

a first control unit which writes the data transmitted from said host unit into said first data storage area, writes the copy data of the data written into said first data storage area into said first copy data storage area, and transmits said copy data present in said first copy data storage area to each of said second and third storage systems;

(2) said second storage system comprises:

a second data storage area for storing a copy of the data present in said first data storage area as a secondary volume;

a second copy data storage area for storing said copy data transmitted from said first control unit; and

a second control unit which receives said copy data at a timing independently from said third storage system, writes the copy data into said second copy data storage area, writes a copy of the data present in said first data storage area into said second data storage area based on said copy data present in said second copy data storage area at an independently scheduled restore timing; and

(3) said third storage system comprises:

a third data storage area for storing a copy of the data present in said first data storage area as a second secondary volume;

a third copy data storage area for storing said copy data transmitted from said first control unit; and

a third control unit which receives said copy data at a timing independently from said second storage system, writes the copy data into said third copy data storage area, writes a copy of the data present in said first data storage area into said third storage area based on said copy data present in said third copy data storage area, and

said first control unit of said first storage system detects as to whether or not said copy data present in said first copy data storage area has been transmitted to said second and third storage systems, holds said copy data present in said first copy data storage area until the copy data is transmitted to both said second and third storage systems, and can delete said copy data present in said first copy data storage area after the copy data has been transmitted to both said second and third storage systems.

22. (New) The data processing system according to claim 21, wherein

(1) said first storage system comprises:

a plurality of physical storage units;

said first control unit of said first storage system comprises a host adapter for exchanging data with said host device, a disk adapter for exchanging data with said plurality of physical storage units, and a cache memory for storing the data received by said host adapter and the data received by said disk adapter; and

said first control unit allocates the storage areas held by said plurality of physical storage units in said first storage system to said first data storage area and said first copy data storage area;

(2) said second storage system comprises:

a plurality of physical storage units;

said second control unit of said second storage system comprises a host adapter for exchanging data with said first storage system, a disk adapter for exchanging data with said plurality of physical storage units, and a cache memory for storing the data received by said host adapter and the data received by said disk adapter; and

said second control unit allocates the storage areas held by said plurality of

physical storage units in said second storage system to said second data storage area and said second copy data storage area; and

(3) said third storage system comprises:

a plurality of physical storage units;

said third control unit of said third storage system comprises a host adapter for exchanging data with said first storage system, a disk adapter for exchanging data with said plurality of physical storage units, and a cache memory for storing the data received by said host adapter and the data received by said disk adapter; and

said third control unit allocates the storage areas held by said plurality of physical storage units in said third storage system to said third data storage area and said third copy data storage area.

23. (New) The data processing system according to claim 21, wherein

said third control unit of said third storage system controls the time interval of said copy data transmitted according to the number of copy data that has been transmitted from said first transmitted storage area.

24. (New) The data processing system according to claim 21, wherein

said third control unit of said third storage system controls the time interval of said copy data transmitted according to the communication quantity of data exchanged between said first storage system and said third storage system.

25. (New) The data processing system according to claim 21, wherein

said third control unit of said third storage system controls the time interval of said copy data transmitted according to the storage capacity of said copy data held in said third data storage area.

26. (New) The data processing system according to claim 21, wherein

said third control unit of said third storage system controls the time interval of said copy data transmitted according to the processing load of said third storage system.

27. (New) The data processing system according to claim 21, wherein

said third control unit of said third storage system receives from said first storage system information relating to the storage capacity of said copy data held in said first copy data storage area in said first storage system and controls the time interval of said copy data transmitted according to the information relating to the storage capacity of said copy data that was transmitted.

28. (New) The data processing system according to claim 21, wherein

said first storage system owns management information relating to said first copy data storage area; and

said third control unit of said third storage system receives from said first storage system the management information relating to said first copy data storage area, which is owned by the first storage system, and controls the time interval of said copy data transmitted according to the management information relating to said first copy data storage area that was transmitted.

29. (New) The data processing system according to claim 21, wherein

said first data storage area in said first storage system has a plurality of logical volumes;

said first control unit writes into said first copy data storage area a plurality of copy data each corresponding to a plurality of data stored in said plurality of logical volumes;

information relating to an update sequence of said plurality of data, each corresponding to said plurality of copy data, is contained in said plurality of copy data stored in said first copy data storage area; and

each of the second and third control units of said second and third storage systems produces copies of said plurality of data based on said plurality of copy data according to said update sequence contained in said plurality of copy data transmitted from said first storage system and writes those copies in respective said second and third data storage areas.

30. (New) The data processing system according to claim 21, wherein

said third storage system controls said restore timing according to the processing load of said third storage system.